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Fostering the generic interpretation of grammatically masculine forms: When my aunt could be one of the mechanics.

Arik Lévy, Pascal Gygax

University of Fribourg, Switzerland

Ute Gabriel

Norwegian University of Science and Technology, Trondheim, Norway

Address for correspondence:
Arik Lévy
Département de Psychologie
University de Fribourg
Rue Faucigny 2
1700 Fribourg, Switzerland
Tel.: +41 (0)26 300 74 76
arik.levy@unifr.ch

Abstract

The masculine plural form in French (e.g., *musiciens* [musicians]), as in other grammatical gender languages, though interpretable as a generic form (e.g., *musicians are men and women*), has been shown to more likely activate a specific interpretation (e.g., *musicians are mainly men*). In this study, we presented participants with *female* or *male kinship – role noun* word-pairs (e.g., *oncle* or *tante – musiciens* [*uncle* or *aunt – musicians*]) and asked them if the person represented by the kinship term could be part of the group represented by the role noun. Most importantly, within the experiment, we gradually increased participants' exposure to pairs including a female kinship. We found that our exposure manipulation did increase readers' general acceptance of *female kinship – role noun* word-pairs, supporting the idea that implicit exposure to particular stimuli might be quite effective in changing associated representations.

Key words: text comprehension, gender representation, masculine bias, implicit manipulation, exposure effects

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When referring to a person, speakers of a grammatical gender language, such as French, are obliged to pay attention to the sex of the person they are referring to: The French language provides morphological and grammatical cues to distinguish referents according to their sex. Therefore, to express an event such as "the teacher was upset with the class" speakers have to select from *l(e) enseignant* [male teacher] and *l(a) enseignante* [female teacher]. In such instances, grammatical gender becomes meaningful as a bearer of semantic information. However, French lacks a noun class to indicate cases in which referents' sex is unknown or irrelevant, or – if referring to a group of people – it comprises both sexes. Although there are different ways to express unawareness or irrelevance of sex (e.g., *La personne qui enseigne* [the person who teaches]) and instances of groups of mixed gender (e.g. *Les enseignants et enseignantes* [male and female teachers]), grammatically masculine forms are most frequently used to fulfil this function (e.g., Sarrasin, Gabriel & Gygax, 2012). This is called the *generic* use of the masculine.

The dual use of role nouns' masculine forms and especially its use in the *plural form* can lead to semantic ambiguity (Irmen & Kurovskaja, 2010): In French, the masculine plural form can refer to a group composed either exclusively of men – the masculine as *specific* – or to a mixed group of women and men – the masculine as *generic*. Previous research in French (e.g., Gygax & Gabriel, 2008; Gygax et al., 2008; Gygax, et al., 2012; Garnham et al., 2013) as well as in other grammatical gender languages (e.g., in German, e.g., Irmen, 2007, Stahlberg et al., 2007; in Spanish, Carreiras, Garnham, Oakhill, & Cain, 1996, Flaherty, 2001) suggests that readers tend to spontaneously interpret masculine grammatical information as specific, thus resolving ambiguity to the *dis*advantage of a generic (i.e., women including) interpretation.

Against the background of these empirical findings, investigating the malleability of the activation and use of grammatical information becomes a relevant issue, both from a scientific and a

political point of view. In this research we ask whether the seemingly spontaneous selection of the specific meaning of the masculine grammatical form is sensitive to exposure effects. We actually concentrate on an accentuated exposure of certain gender associations as a modulating variable, which we operationalize in a word-pair association task. In other words, we investigate whether certain meaning activations can be modulated by participants being exposed to particular associations.

Meaning activation model

Processing a role noun in the masculine form activates associated features (e.g., semantic, morphological and/or phonological features) that are most relevant when selecting its meaning (Gorfein & Brown, 2007; Gorfein, Brown & DeBiasi, 2007). As advocated by the activation-selection model (Gorfein, Brown & DeBiasi, 2007), words are represented by a set of weighted attributes, of which the initial activation depends on their actual weight. Selection of a particular meaning subsequently increases the weight of the attributes associated with this meaning. In other words, the initial activation of specific attributes increases the likelihood of future activations of associated meanings.

In terms of *specific* vs. *generic* meanings of the masculine form and for any given reader/listener, it could well be the case that attributes associated with its specific meaning have gained, over time, stronger weights than those associated with its generic meaning. Put differently, readers or listeners may more likely select the specific meaning of the masculine form as a result of accentuated exposure to the implicit *masculine* = *male* associations. In fact, Gygax et al. (2010) even argued that until the age of approximately seven to eight years, children (i.e., French speaking children in Switzerland) are, almost exclusively, only exposed to *masculine* = *male* associations, as they have not yet formally learnt the generic use of the masculine form.

Consequently, changing the relative weights of the attributes associated with *specific* vs. *generic* meanings might be the only option for readers to embrace a generic interpretation of the

masculine form. Previous research on situational influences on the interpretation of the masculine form in French is in line with this notion. Adapting an experimental paradigm from Oakhill, Garnham and Reynolds (2005; based on Banaji & Hardin, 1996), Gygax and Gabriel (2008) presented students with word pairs, which consisted of a kinship term in the singular form and a role noun in the masculine plural form. Participants were instructed to discriminate whether the person introduced by the kinship term (e.g., *aunt*) could be part of the group presented by the role noun (e.g., *mechanics*). Kinship terms were either female or male, and role nouns were selected to present stereotypically female, stereotypically male and non-stereotyped (neutral) roles. Filler items consisted of incongruent word pairs using role nouns of definitional gender (e.g., uncle - brides; mother - kings). Gygax and Gabriel (2008) found that participants responded positively less often when pairs included a female kinship (e.g., *sister*), irrespective of gender stereotype, indicating the selection of a gender specific meaning of the role nouns (Exp. 1). In a second experiment, prior to conducting the discrimination task, participants performed an ostensibly independent text comprehension task, which was based on job advertisements. A series of positions were advertised either in the *masculine form only* or in both *masculine and feminine* forms. Importantly, participants who had earlier been exposed to job advertisements using both masculine and feminine forms were less likely to respond positively to *female kinship – masculine role noun* pairs than those who had been exposed to masculine forms only. In terms of competing meanings of the masculine form in the discrimination task, we now argue that in Gygax and Gabriel's (2008) second experiment, presenting the feminine form along with the masculine one in the pre-experimental task increased the weight of the *masculine = male* association, consequently decreasing the likelihood of accepting *female kinship – role noun in the masculine form* pairs in the experimental task.

Using the same paradigm, Gygax et al. (2012) explored whether explicitly reminding participants that the masculine form could be used generically would reverse their tendency to lean towards a specific interpretation. Although they did find the reminder led to an increase of positive

responses to *female kinship – role noun in the masculine form* pairs, participants continued to take longer to positively respond to those pairs compared to *male kinship – role noun in the masculine form* pairs.

Given that response times might more accurately reflect the immediate content of participants' mental representations (Keenan, Potts, Golding, & Jennings, 1990), the authors suggested that the specific meaning of the masculine role nouns were activated through a passive and hard-to-control process (i.e., a resonance mechanism), whereas the generic meaning needed active processing. In terms of the activation-selection model, explicitly reminding readers of the *masculine = generic* association was not sufficient to *spontaneously* activate its attributes.

In the present study, as detailed below, we attempted to more subtly and implicitly target those attributes to compel readers to select the generic meaning when processing role nouns in the masculine form. Namely, we manipulated participants' exposure to *female kinship – role noun in the masculine form* pairs by gradually changing the ratio *female/male kinship – role noun in the masculine form* pairs.

In addition, we took individual differences into account and explored whether holding a gendered world view might hinder the generic interpretation of masculine role nouns. More specifically, we asked whether people who accentuate gender differences and/or have been exposed to accentuations of gender differences are more likely to be impermeable to our ratio manipulation.

The present research

Using the same paradigm as in Gygax and Gabriel (2008) and Gygax et al. (2012), we try to target the passive processes behind the activation of the specific interpretation of the masculine form by manipulating the frequency of occurrence (i.e., an implicit manipulation) of the different pair-conditions (i.e., *female kinship-role nouns* and *male kinship-role nouns*). The idea behind this manipulation is that a higher frequency of occurrences of female characters associated to different role nouns might trigger an increased activation of female representations, hence countering the

passive activation of a masculine-specific interpretation. Put differently, on the basis that explicit instructions seem inadequate to tackle the spontaneous activation of the specific interpretation of the masculine form (as in Gygax et al., 2012), implicit exposure to a higher frequency of occurrences of female characters associated with different role nouns may push the activation of the generic interpretation, maybe even to the extent of supplanting the specific interpretation of the masculine form. If the processes that were identified by Gygax et al. (2012) are truly passive, a frequency manipulation (i.e., making people effortlessly select the generic interpretation) should work better than an explicit manipulation (i.e., making people monitor their selection).

Provided that the generic interpretation is the initially activated one – consequently altering the mental representation of gender when reading role nouns written in the masculine form –, a subsequent issue to examine is the strength of this generic interpretation. One way to do this was introduced by Gygax and Gabriel (2008). In half of their first experiment, they only presented participants with *kinship-role nouns in the masculine form* pairs, whereas in the second half, participants were also presented with *kinship-role nouns in the feminine form* pairs. Gygax and Gabriel (2008) were interested in examining to what extent the appearance of feminine forms (which by definition are *specific*) would force participants into a (more) specific interpretation of the masculine form, further infringing upon any possible generic interpretation of the masculine form. Their results indicated that although there were signals that participants could embrace as a generic interpretation of the masculine form in the first part of the experiment, this signal (yet not very strong), was weakened by the presence of role nouns written in the feminine form (see Gygax & Gabriel, 2008, for a detailed explanation of the processes at stake). Participants were even less likely to associate female kinship terms with role nouns written in the masculine form as a consequence of the presence of role nouns written in the feminine form, suggesting that the generic interpretation, if present, was quite fragile and sensitive to other contextual cues.

To sum up, the aim of the current study was threefold. First, we examined the effect of an

increased exposure to pairs, including a female kinship and a role noun in the masculine form, on the probability of participants assuming that a woman *can* be part of a group represented by a role noun in the masculine form. Based on the notion that this manipulation strengthens the likelihood of an initial activation of the generic meaning of masculine forms, we expected to see its effects on both the proportion of positive responses and response times. Second, we investigated the strength of any effect of this increased exposure in terms of the sensitivity of participants' responses to the presence of role nouns written in the feminine form. Third and finally, we explored whether people who accentuate gender differences and/or have been exposed to accentuations of gender differences are more likely to be impermeable to our ratio manipulation.

Method

Participants

Forty-eight French-speaking students (36 women: 22.5±6.2 years; and 12 men: 22.4±3.6 years) from the Universities of Fribourg and Lausanne, Switzerland, participated in the experiment. To motivate participation, all participants were entered in a draw to win cinema tickets (20% chance of winning).

Materials

Experimental stimuli.

Participants were presented with pairs of words, with each pair composed of a kinship term in the singular form (e.g., *soeur* [sister]) and a role noun in the masculine plural form (e.g., *musiciens* [musicians]), mirroring Gygax and Gabriel's (2008) procedure. A list of 36 role nouns from Gabriel, Gygax, Sarrasin, Garnham, and Oakhill (2008) was used in this experiment. Twelve role nouns were female stereotyped (e.g., *infirmiers* [nurses]), 12 were male stereotyped (e.g., *mécaniciens* [mechanics]), and 12 were neutral (e.g., *musiciens* [musicians]). The role names are presented in Table 1. Nine female (*mère* [mother], *soeur* [sister], *tante* [aunt], *nièce* [niece], *belle-soeur* [sister-in-law], *belle-mère* [mother-in-law], *petite-fille* [granddaughter], *grand-mère*

[grandmother], and *marraine* [godmother]) and 9 male (e.g., *père* [father], *frère* [brother], *oncle* [uncle], *neveux* [nephew], *beau-frère* [brother-in-law], *beau-père* [father-in-law], *petit-fils* [grandson], *grand-père* [grandfather], *parrain* [godfather]) kinship terms were used. The experiment was divided into four parts. In each part, 9 role nouns (3 female stereotyped, 3 male stereotyped and 3 neutral) were combined with 12 kinship terms, resulting in 108 experimental items per part. The proportion of female kinship terms gradually increased from Part I to Part III, from 25% of female kinship-role noun pairs (i.e., conversely 75% of male kinship-role noun pairs) in Part I, 50% of female kinship-role noun pairs in Part II, to 75% of female kinship-role noun pairs in Part III (see Table 2). As the response to the experimental question "Can the person represented by the kinship term be part of the group represented by the role noun?" could logically always be "yes", 54 fillers items, composed of an unambiguous (i.e., morphologically or semantically gender marked) role noun (e.g., *sage-femmes* [midwifes], *gigolos* [gigolos]) and a gender-inconsistent kinship term (e.g., *midwifes-uncle*), were added to compel participants to consider negative responses. In Part IV, the proportion of female kinship terms was the same as in Part III, but 108 kinship-role noun pairs with the role noun in the feminine form were added (i.e., 216 experimental items) (see Table 2). Adding feminine role nouns had increased the probability of participants to consider the masculine form as specific in Gygax and Gabriel (2008). Again, in Part IV, we were interested in examining to what extent the appearance of feminine forms (which by definition are *specific*) would force participants into a specific interpretation of the masculine form, further infringing upon any possible generic interpretation of the masculine form.

Questionnaires

Each participant completed two different questionnaires. First, participants were given a *Family questionnaire* on their parents' share of household activities (i.e., whether each parent contributed equally to five stereotypically male and five stereotypically female household activities, based on Marshall, 1993) and on the number of male and female siblings (sisters and brothers) they

had. Second, participants completed a French translation of the short version of the Occupation, Activity and Trait scale (Liben et al., 2002) on (1) *sex-typing of the self* (personal measure) and (2) *attitudes towards others* (attitude measure).

Apparatus

Participants were tested individually in a quiet room. The experiment was built with PsyScope Software (Cohen, MacWhinney, Flatt & Provost, 1993) and displayed with a Power Macintosh 4400. The social factors questionnaires were presented in a paper-pencil format.

Procedure

Participants were presented with word pairs, each composed of a kinship term (on the left) and role noun (on the right) and were instructed to decide as quickly as possible if the person represented by the kinship term (e.g., *soeur* [sister]) could be part of a group represented by the role noun (e.g., *musiciens* [musicians]). In our example, if participants thought that a sister could be part of a group of musicians, they pressed the *yes* button, whereas, otherwise, they pressed the *no* button.

Four practice trials (two requiring a positive and two requiring a negative response) preceded the first experimental session (Part I). To ensure that there was no spill-over effect from one part to the next one (i.e., to maximize potential effects of our frequency manipulation), we included the questionnaires (in parts) as interference tasks between the experimental parts. After Part I, participants responded to the questions on their parents' household activities. After Part II, they responded to the questions about the number, gender and age of their siblings. After Part III, they had a short rest. Finally, after Part IV, they completed the Occupations, Activities and Traits questionnaire (both personal and attitude measures). Both of the OAT questionnaires were given after the final part of the experiment to ensure that the questions would not bias the experiment.

Results

We recorded the participants' responses (i.e., yes or no) and the time it took them to

respond. In essence, each measure evaluates how easily participants consider the kinship term as part of the group represented by the role noun. If participants struggle to consider the kinship term (e.g., aunt) as part of the group represented by the role noun (e.g., musicians), they are less likely to respond yes. Still, if they respond yes, it should take them longer to respond if they struggle with the pair. Accordingly, and as in most of the studies presented above, we analysed only *yes* responses, first in terms of proportions of positive responses[1] and second in terms of positive response times.

In order to include both participants and items as random factors in all analyses (both when not considering social variables and when considering them), therefore avoiding the "language-as-fixed-effect-fallacy" (Clark, 1973; Brysbaert, 2007), data were analysed by fitting linear mixed-effects models using the R software (R Development Core Team, 2010, version 2.10.1). This procedure was particularly adequate when analysing positive response times as it reduces cumbersome manipulations of data when there are missing values.

In this experiment, we were particularly interested in the interaction effects of Part (I, II & III) x Kinship, to address the impact of female kinship frequency on the habitual male bias effect – as instantiated by a main effect of Kinship – found in Gygax and Gabriel (2008) and partly in Gygax et al. (2012). As Part IV was primarily present to address the opposing effects of high female kinship frequency vs. the presence of feminine form (two opposing implicit sources of information), analyses were run separately for Parts I, II and III (implicit learning), and Parts III and IV (strength of the learning process).

In the analyses of both the proportion of positive responses and positive response times, we used a first model including only Kinship, to mirror the findings of previous research (i.e., the male bias). We then compared this model to one including Part (our prime interest), and finally one including Stereotype (as in Gygax & Gabriel, 2008, and Gygax et al., 2012). Models were tested using the *lmer()* function of the *lmer4* package of R, and model comparisons were assessed using

the *anova()* function, which calculate the Chi-square value of the log-likelihood in order to evaluate the difference between models, following Baayen's (2008) procedure. Finally, the p-values, F-values and degrees of freedom estimates[2] were obtained with the *aovlmer.fnc()* function.

Proportion of positive responses.

Only the proportions of responses to experimental pairs including a role noun in the masculine form were analysed, as we were exclusively focused on the possibility of interpreting the masculine form as generic.

Implicit Learning (Parts I, II and III). Our first model included Kinship as fixed factor and participants and items as random factors. When Part was added as fixed factor, it significantly improved the model ($\Delta\chi^2 = 69.29$, $\Delta df = 4$, $p < .001$). Still, adding Stereotype further improved its fitness ($\Delta\chi^2 = 51.07$, $\Delta df = 12$, $p < .001$). The final model revealed a main effect of Part, F (2, 15534) = 72.11, $p < .001$, the overall proportion of positive responses decreasing with Part (Part 1: .92; Part II: .88; Part III: .83), and a main effect of Kinship (F (1, 15534) = 1248.64, $p < .001$), the proportion of positive responses to pairs including a male kinship term (.97) being higher than pairs including a female kinship term (.78). There was also a most crucial Part by Kinship interaction effect (F (2, 15534) = 32.41, $p < .001$), the proportion of positive responses to pairs including a female kinship term increasing from Part I to Part III kinship (Part I: .72; Part II: .78; Part III: .79) whilst slightly decreasing for the proportion of responses to pairs including a male kinship (Part I: .98; Part II: .97; Part III: .94), as illustrated by Figure 1.

(Figure 1 about here)

There was also a significant Kinship by Stereotype interaction effect (F (2, 15534) = 11.07, $p < .001$); the difference between the proportion of positive responses to *male kinship-role noun* pairs and *female kinship-role noun* pairs was smaller in the male stereotyped condition (.16) than in

the female stereotyped (.17) and the neutral stereotyped conditions (.18). There was also a Part by Stereotype interaction effect (F (6, 15534) = 3.51, $p < .01$), showing that the general decrease of the proportion of positive responses across parts was higher for male-stereotyped role nouns (proportion of positive response in Part III minus Part I: .10) than for the neutral-stereotyped role nouns (.08) and the female-stereotyped role nouns (.07).

Strength of Implicit Learning (Parts III and IV). Our first model included Kinship as fixed factor, with participants and items as random factors. When Part was added as fixed factor, it significantly improved the model ($\Delta\chi^2 = 979.71$, $\Delta df = 2$, $p < .001$). Adding Stereotype further improved its fitness ($\Delta\chi^2 = 29.20$, $\Delta df = 8$, $p < .001$). The final model revealed a main effect of Part (F (1, 10356) = 805.78, $p < .001$), with the overall proportion of positive responses being higher in Part III (.83) compared to Part IV (.66), and a main effect of Kinship (F (1, 10356) = 1322.16, $p < .001$), asserting, not surprisingly, that participants responded positively more often to pairs including a male kinship term (.94) than those including a female kinship term (.68).

However, and most importantly, there was a Part by Kinship interaction effect (F (1, 10356) = 229.26, $p < .001$); the proportion of positive responses decreased from Part III (.80) to Part IV (.57) only for pairs including a female kinship, whilst remaining relatively unchanged for pairs including a male kinship (Part 3: .94 and Part 4: .93), as illustrated in Figure 2. Although the Kinship effects changed from Part I to Part III, signalling a better integration of the generic interpretation of the masculine form, the presence of feminine (specific) forms impacted upon the interpretation of the masculine form (i.e., back to a specific interpretation).

(Figure 2 about here)

There was also a Kinship by Stereotype interaction effect (F (4, 10356) = 7.32, $p < .001$), showing that the greater proportion of positive responses to pairs including a male kinship

compared to a female kinship term was more pronounced for male-stereotyped role nouns (proportion of positive responses to pairs including a male kinship minus the proportion for pairs with a female kinship: .29) than for female- (.23) or neutral-stereotyped role nouns (.25). No other interaction was significant.

Positive response times.

As role nouns varied in number of letters, we first transformed, for each participant, raw positive response times into residual times, following Trueswell, Tanenhaus and Garnsey's (1994) regression method. For each participant, a *time* (i.e., reading time) by *role noun length* (i.e., number of characters in the target role noun) regression was calculated by computing the slope and the intercept of the regression. Residual response times for each participant were then calculated by subtracting the actual raw response times from the response times predicted by the regression equation. We then transformed the residual times into *z*-scores per *participant* per *Part* in order to overcome the natural acceleration of response times across the experiment (i.e., people get habitually faster). All analyses were conducted on the *z*-scores. Note that the higher the z-score, the faster the response was.

Implicit Learning (Parts I, II and III). Our first model included Kinship as fixed factor, and participants and items as random factors. When Part was added as fixed factor, it significantly improved the model ($\Delta\chi^2 = 88.36$, $\Delta df = 4$, $p < .001$). Adding Stereotype further improved its fitness ($\Delta\chi^2 = 47.15$, $\Delta df = 12$, $p < .001$). The model revealed a significant main effect of Kinship (F (1, 13587) = 151.61, $p < .001$), with participants responding faster to male (.12 standard deviations) than female kinship (-.15 standard deviations), as illustrated in Figure 3. Most importantly, and mirroring the effects found on the proportions of positive responses, the model revealed a Kinship by Part interaction (F (4, 13587) = 22.10, $p < .001$), with positive response times only accelerating across parts for pairs including a female kinship from Part I (-.36), to Part II (-.18) and to Part III (-.05), yet always slower than for pairs including a male kinship, which was almost constant across

parts (Part I: .09; Part 2: .15; Part 3: .14), as illustrated in Figure 3. Again, reproducing the effects found on the proportions of positive responses, the model revealed a Kinship by Stereotype interaction (F (4, 13587) = 9.29, $p < .001$), with pairs including a male kinship term being responded to much faster than pairs including a female kinship term (i.e., a Kinship effect) for male-stereotyped role nouns (difference of .35) than for neutral-stereotyped role nouns (difference of .24), and for female role noun (difference of .19). No other interactions were significant.

(Figure 3 about here)

Strength of Implicit Learning (Parts III and IV). Our first model included Kinship as fixed factor, with participants and items as random factors. When Part was added as fixed factor, it significantly improved the model ($\Delta\chi^2 = 31.57$, $\Delta df = 2$, $p < .001$). Adding Stereotype further improved its fitness ($\Delta\chi^2 = 17.74$, $\Delta df = 8$, $p < .05$). The model revealed a main effect of Kinship (F (1, 7733) = 31.83, $p < .001$), with participants responding faster to pairs that included a male kinship (.07 standard deviations) than those that included a female kinship (-.11 standard deviations).

Signalling an effect of the presence of role nouns in the feminine form, the model revealed a Kinship by Part interaction (F (2, 7733) = 15.99, $p < .001$), with positive response times to pairs including a female kinship showing a greater deceleration from Part III to Part IV (.21 standard deviation difference) than pairs including a male Kinship (.15 standard deviation difference), as illustrated in Figure 4.

(Figure 4 about here)

Finally, the model revealed a Kinship by Stereotype interaction effect (F (4, 13587) = 9.29,

$p < .001$); the habitual Kinship effect (i.e., pairs with a male kinship being responded to faster than pairs including a female kinship) was larger for pairs that included male and neutral-stereotyped role nouns (.23 standard deviation difference between pairs with male and female kinship terms) than for pairs that included female-stereotyped role nouns (.07 standard deviation difference between pairs with male and female kinship terms). No other interaction reached significance level.

As a final set of analyses, we explored social factors as a possibility for explaining the results presented so far in both the *Implicit Learning* and *Strength of Implicit Learning* sections. In spite of many attempts to account for individual differences, none succeeded in explaining any of the variance described above. Henceforth, we will not present any of these attempts nor discuss in length any of the social factors investigated.

Discussion

The aim of the current study was threefold. First, we investigated, in French, possible effects of an increased exposure to pairs including a female kinship and a role noun in the masculine form on the probability of participants assuming that a woman *can* be part of a group represented by this role noun. Second, we investigated the strength of these possible effects in terms of participants' sensitivity to the presence of role nouns written in the feminine form (i.e., a specific form); which had earlier been shown (Gygax & Gabriel, 2008) to compel readers to interpret the masculine form as specific. Third and finally, we evaluated whether social factors may have influenced participants' responses to our experimental manipulations. Note that although these hypotheses are focused on French, we believe that they are relevant across most grammatical gender languages. In fact, there is very little evidence to doubt that other languages using similar grammatical gender structures would show different results.

As expected, increased exposure to female kinship terms led participants to adopt a more generic interpretation of the masculine form, signalled by a growing proportion of positive responses and accelerating response times to *female kinship-role nouns in the masculine form*

across the different exposure parts. Our findings therefore show that a simple increased exposure to female kinship terms may be sufficient to activate a more generic interpretation of the masculine form, over a more specific one, though not completely overriding the specific interpretation. This result is important for two reasons. First, previous attempts to alter readers' spontaneous representation, whether stereotyped (Oakhill et al., 2005) or grammatically-induced (Gygax et al., 2012), have not been entirely successful. In both studies, participants were explicitly instructed to distance themselves from their habitual biases (stereotype or the specific interpretation of the masculine). In the former, both proportions of positive responses and response times indicated that participants could not distance themselves from stereotypical influences. In the latter, if the proportions of positive responses did reflect that participants could embrace a generic interpretation of the masculine form (instead of the habitual specific interpretation), response times signalled that they were struggling to do so (i.e., no difference in response times before and after the explicit instructions). In this present paper, both the proportions of positive responses and response times reflected the same process: A gradual shift from a generic interpretation of the masculine form to a more generic one as a consequence of increased exposure to female exemplars.

Second, our findings may support the idea that the activation of the specific interpretation of the masculine form is made through a passive bottom-up process (e.g., resonance mechanism), as suggested by Gygax et al. (2012), and that only implicit associations can truly alter this passive activation. The passive nature of the processes at stake was confirmed by the fact that, in a post-experimental check, no participant noticed the increased proportion of *female kinship-role nouns in the masculine form*. This supports the notion that access to long-term memory information (assuming that both specific and generic interpretations are stored in LTM) "is not directed by the relevance of the information or by the goals of the reader" (O'Brien & Myers, 1999, p48). In terms of the activation-selection model (Gorfein et al., 2007), increasing the proportion of exemplars with female kinship terms most likely changed the weight of the attributes associated with a generic

interpretation of the masculine form, consequently raising the probability of its activation.

However, although we managed to find some evidence that the spontaneous specific interpretation can vary, as a function of implicit exposure to female exemplars, when participants were also presented with role nouns in the feminine form - specific by nature – (Part IV), our data suggested that the activation of a generic interpretation dropped drastically, though not completely (proportions still higher than mid-point). Note that in both experiments in Gygax and Gabriel (2008), when role nouns in the feminine form were presented, proportions of positive responses to *female kinship-role nouns in the masculine form* dropped below mid-point, hinting that the implicit learning in this present experiment may have impacted upon the strength of the activation of the generic interpretation. This last comment is to be taken with caution, as four years separate their study from ours. Differences in response patterns could also be attributed to a more extensive exposition of new ways of expressing gender through strategies such as *visibility by feminization* in French and German (i.e., use of splitting forms such as *étudiant-e* [student]). In a sense, if this were the case, it would also constitute supplementary evidence of the impact of implicit exposition on gender representation.

Our third interest lay in the idea that our participants' sensitivity to our experimental manipulations as well as the resulting mental representations could be explained in terms of social factors. Our results were not encouraging, mainly because none of our individual differences measures truly explained the processes at stake in our experiment. The lack of effect of our social factors could well be explained by the passive nature of the processes involved (see discussion above), with their activation being more or less stable (though they can fluctuate with some implicit manipulations) and unavoidable. One could also argue that our sample may have suffered from exaggerated homogeneity in terms of the social factors investigated, and that pre-sampling – sampling those whose scores are extreme –, may be better suited to more accurately testing the influence of social factors on gender representations.

In conclusion, our results have two main implications in terms of applied perspectives. First and foremost, we showed that, taken together with Gygax et al., (2012), implicit influences may well be more efficient in compelling readers (and speakers) to understand the masculine form in a generic way. If reminding readers of the generic interpretation of the masculine form seemed ineffective to affect any spontaneous activation of its specific interpretation (Gygax et al., 2012), increasingly exposing readers to certain generic-bound exemplars did impact upon the interpretation of the masculine form. Second, and related to the first point, our results support the more general idea that changes in representations (or, broadly put, in the way people interpret the world) might be more effective if realized by repeated exposure to particular stimuli rather than by explaining to people how their representations could or should be. Nonetheless, we failed at finding the individual characteristics in terms of social influences that could sustain the process of gender representation at stake in our findings.

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Footnotes

[1] Concretely, we dropped *no* responses from the analyses, henceforth not violating any assumption of independence when running our analyses.

[2] The *aovlmer.fnc()* function computes p-values for factors in a mixed-effects model on the basis of an MCMC sample.

Table 1

French role names chosen from Gabriel et al. (2008) along with their associated perceived proportions of men.

	Role names	*English translation*	%
Male stereotypes	Espions	*Spies*	74
	Golfeurs	*Golfers*	73
	Politiciens	*Politicians*	72
	Policiers	*Police officers*	70
	Statisticiens	*Statisticians*	74
	Patrons	*Bosses*	74
	Informaticiens	*Computer specialists*	67
	Chirurgiens	*Surgeons*	75
	Techniciens	*Technicians*	75
	Ingénieurs	*Engineers*	74
	Etudiants en physique	*Physics students*	67
	Aviateurs	*Pilots*	74
		Mean	72
Neutral stereotypes	Chanteurs	*Singers*	48
	Promeneurs	*Pedestrians*	52
	Spectateurs de cinéma	*Cinema goers*	50
	Auditeurs de concert	*Concert goers*	51
	Ecoliers	*Schoolchildren*	53
	Spectateurs	*Spectators*	51
	Voisins	*Neighbours*	50
	Nageurs	*Swimmers*	50
	Joueurs de tennis	*Tennis players*	54
	Auteurs	*Authors*	54
	Musiciens	*Musicians*	59
	Skieurs	*Skiers*	55
		Mean	52
Female stereotypes	Esthéticiens	*Beauticians*	18
	Assistants maternels	*Birth attendants*	18
	Diseurs de bonne aventure	*Fortune tellers*	28
	Caissiers	*Cashiers*	24
	Infirmiers	*Nurses*	30
	Coiffeurs	*Hairdressers*	38
	Etudiants en psychologie	*Psychology students*	33
	Diététiciens	*Dieticians*	37
	Couturiers	*Dressmakers*	40
	Danseurs	*Dancers*	29
	Vendeurs	*Sales assistants*	37
	Assistants sociaux	*Social workers*	33
		Mean	30

Table 2

Detailed description of the different Phases and their associated ratios. Subscripts indicate whether a word is grammatically *masculine* (*m*), or *feminine* (*f*), and *plural* (*pl*).

	Kinship Female/Male ratio	Grammatical gender of role noun	Examples	
			Kinship term	Role noun
Part I	1:3	Masculine	*frère*$_m$ [brother$_m$] *grand-père*$_m$ [grandfather$_m$] *neveu*$_m$ [nephew$_m$] *belle-soeur*$_f$ [sister-in-law$_f$]	*chanteurs*$_{m\text{-}pl}$ [singers$_{m\text{-}pl}$] *golfeurs*$_{m\text{-}pl}$ [golfers$_{m\text{-}pl}$] *caissiers*$_{m\text{-}pl}$ [cashiers$_{m\text{-}pl}$] *skieurs*$_{m\text{-}pl}$ [skiers$_{m\text{-}pl}$]
Part II	1:1	Masculine	*frère*$_m$ [brother$_m$] *grand-mère*$_f$ [grandmother$_f$] *neveu*$_m$ [nephew$_m$] *belle-soeur*$_f$ [sister-in-law$_f$]	*chanteurs*$_{m\text{-}pl}$ [singers$_{m\text{-}pl}$] *golfeurs*$_{m\text{-}pl}$ [golfers$_{m\text{-}pl}$] *caissiers*$_{m\text{-}pl}$ [cashiers$_{m\text{-}pl}$] *skieurs*$_{m\text{-}pl}$ [skiers$_{m\text{-}pl}$]
Part III	3:1	Masculine	*soeur*$_f$ [sister$_f$] *grand-mère*$_f$ [grandmother$_f$] *neveu*$_m$ [nephew$_m$] *belle-soeur*$_f$ [sister-in-law$_f$]	*chanteurs*$_{m\text{-}pl}$ [singers$_{m\text{-}pl}$] *golfeurs*$_{m\text{-}pl}$ [golfers$_{m\text{-}pl}$] *caissiers*$_{m\text{-}pl}$ [cashiers$_{m\text{-}pl}$] *skieurs*$_{m\text{-}pl}$ [skiers$_{m\text{-}pl}$]
Part IV	3:1	Masculine and feminine	*soeur*$_f$ [sister$_f$] *grand-mère*$_f$ [grandmother$_f$] *neveu*$_m$ [nephew$_m$] *belle-soeur*$_f$ [sister-in-law$_f$] *soeur*$_f$ [sister$_f$] *grand-mère*$_f$ [grandmother$_f$] *neveu*$_m$ [nephew$_m$] *belle-soeur*$_f$ [sister-in-law$_f$]	*chanteurs*$_{m\text{-}pl}$ [singers$_{m\text{-}pl}$] *golfeurs*$_{m\text{-}pl}$ [golfers$_{m\text{-}pl}$] *caissiers*$_{m\text{-}pl}$ [cashiers$_{m\text{-}pl}$] *skieurs*$_{m\text{-}pl}$ [skiers$_{m\text{-}pl}$] *chanteuses*$_{f\text{-}pl}$ [singers$_{f\text{-}pl}$] *golfeuses*$_{f\text{-}pl}$ [golfers$_{f\text{-}pl}$] *caissières*$_{f\text{-}pl}$ [cashiers$_{f\text{-}pl}$] *skieuses*$_{f\text{-}pl}$ [skiers$_{f\text{-}pl}$]

Figure Captions

Figure 1. Mean proportions (and SE bars) of positive responses in Parts I, II & III by stereotypicality of role noun.

Figure 2. Mean proportions (and SE bars) of positive responses in Parts III & IV by stereotypicality of role noun.

Figure 3. Mean response times (and SE bars) in Z-scores of positive responses in Parts I, II & III by stereotypicality of role noun. Negative means signal slower response times.

Figure 4. Mean response times (and SE bars) in Z-scores of positive responses in Parts III & IV by stereotypicality of role noun. Negative means signal slower response times.

Figure 1.

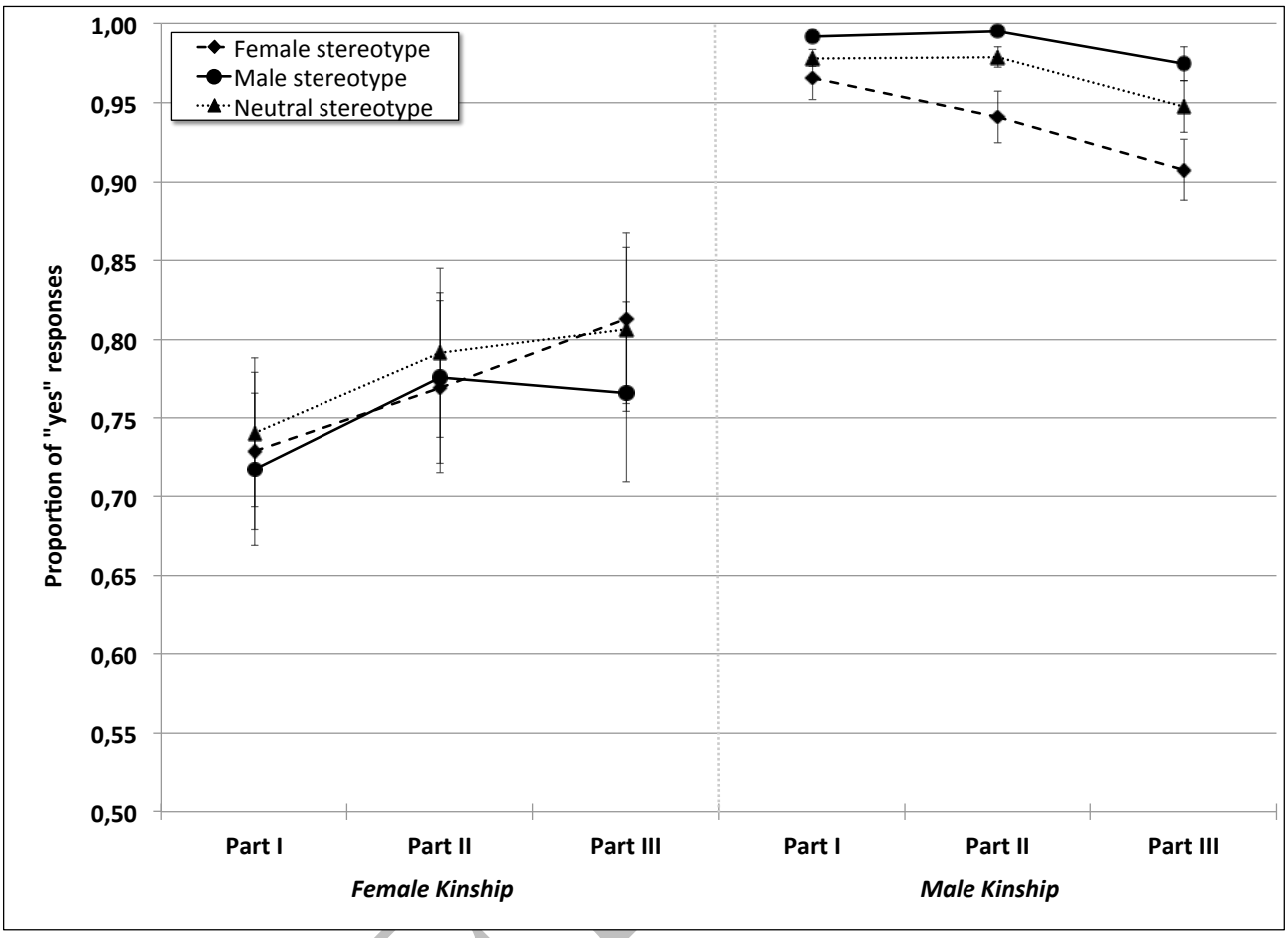

Female stereotype
Male stereotype
Neutral stereotype
Proportion of "yes" responses
1,00
0,95
0,90
0,85
0,80
0,75
0,70
0,65
0,60
0,55
0,50
Part I
Part II
Part III
Part I
Part II
Part III
Female Kinship
Male Kinship

Figure 2.

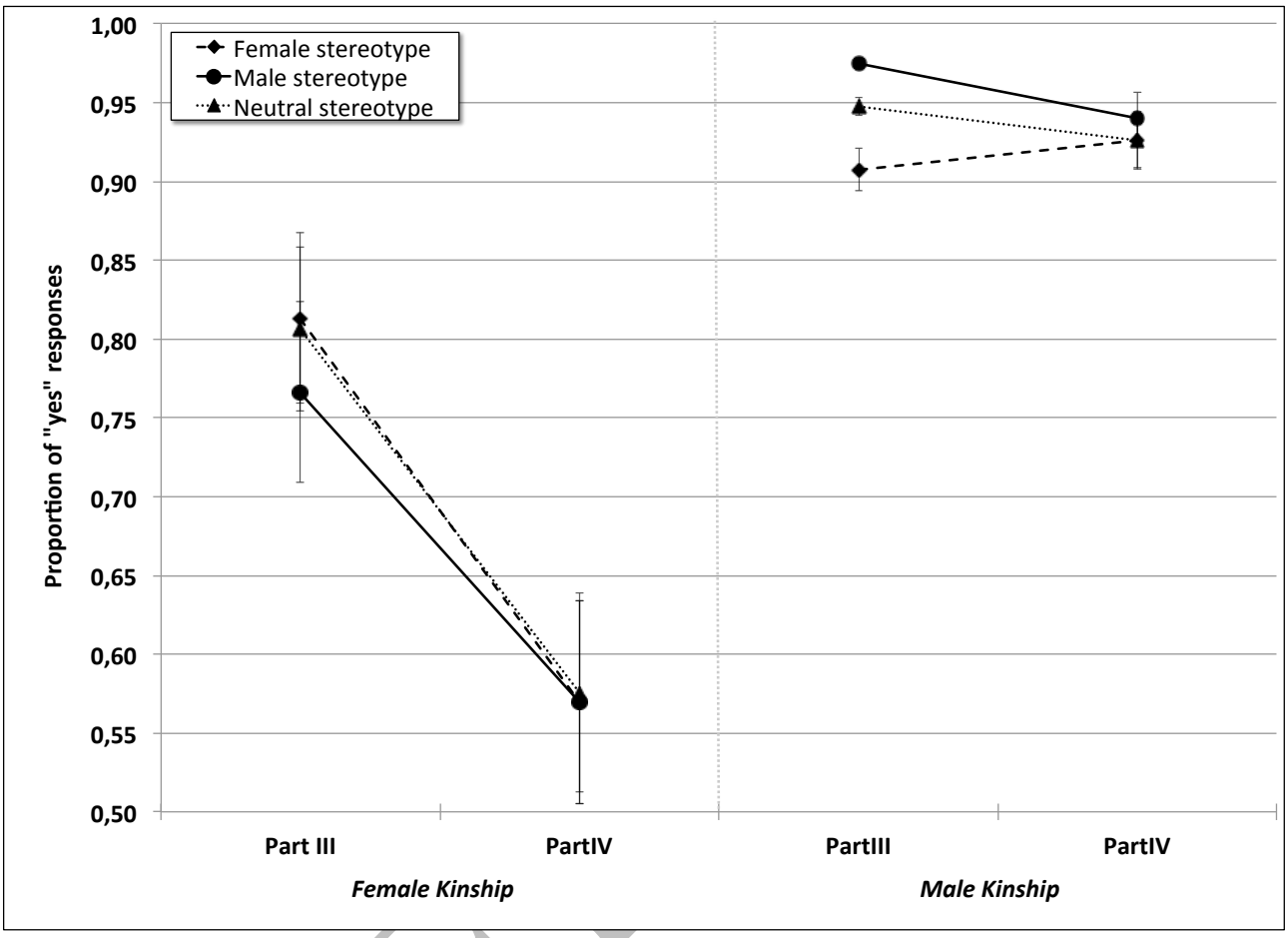

Female stereotype
Male stereotype
Neutral stereotype
Proportion of "yes" responses
1,00
0,95
0,90
0,85
0,80
0,75
0,70
0,65
0,60
0,55
0,50
Part III
PartIV
PartIII
PartIV
Female Kinship
Male Kinship

Figure 3.

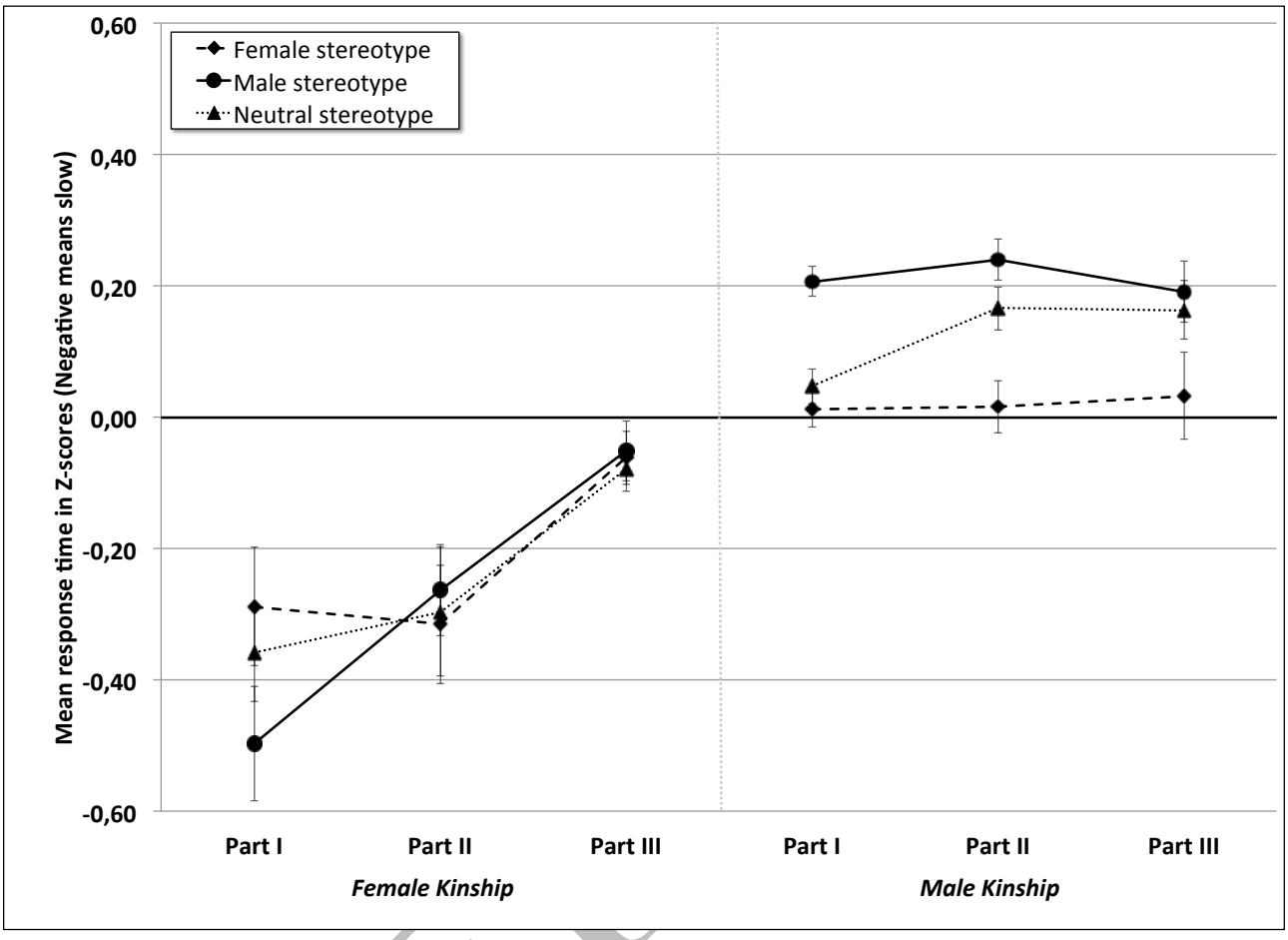
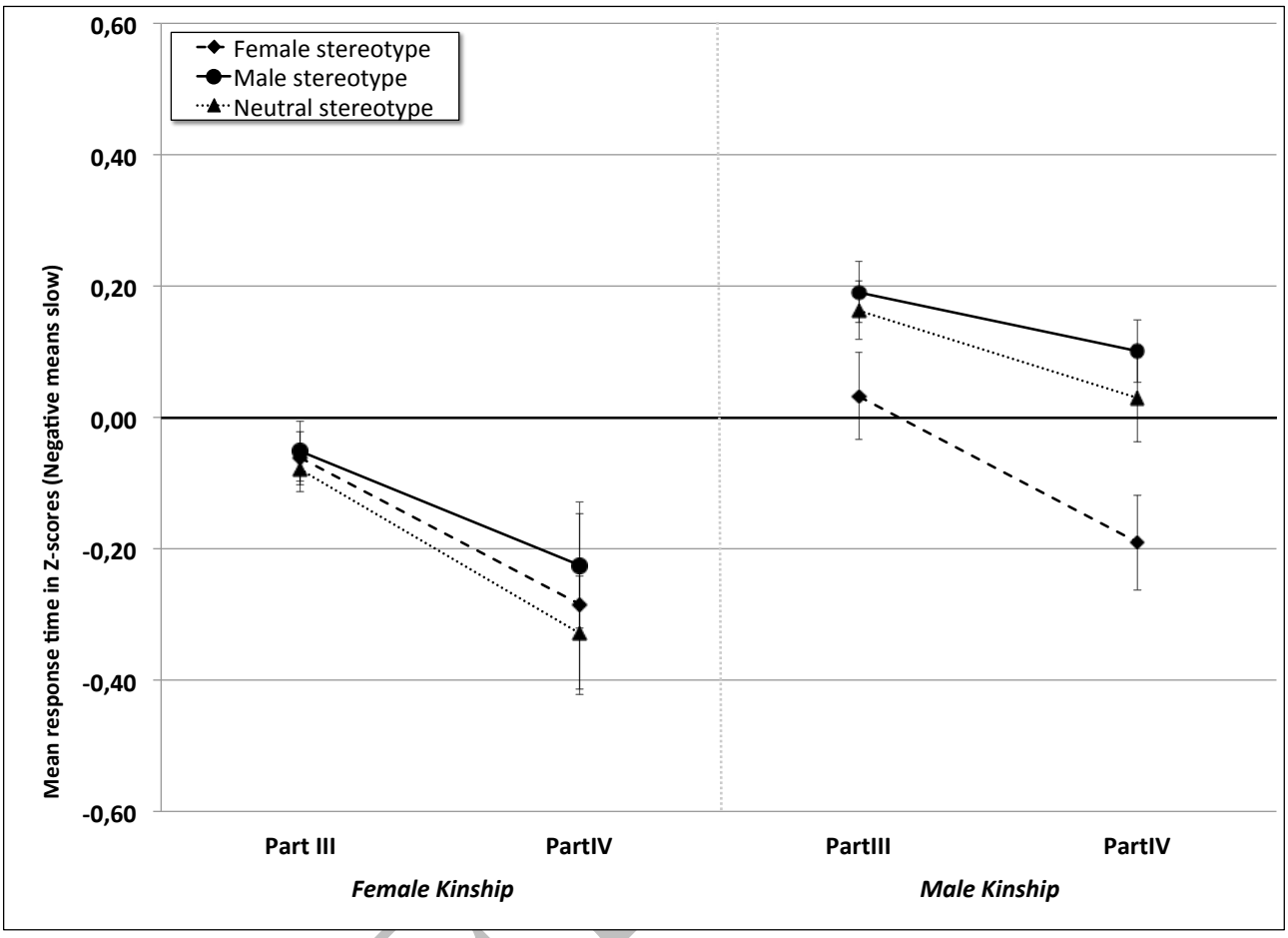

Female stereotype
Male stereotype
Neutral stereotype
Mean response time in Z-scores (Negative means slow)
0,60
0,40
0,20
0,00
-0,20
-0,40
-0,60
Part I
Part II
Part III
Part I
Part II
Part III
Female Kinship
Male Kinship

Figure 4.


Female stereotype
Male stereotype
Neutral stereotype
0,60
0,40
0,20
0,00
-0,20
-0,40
-0,60
Mean response time in Z-scores (Negative means slow)
Part III
PartIV
PartIII
PartIV
Female Kinship
Male Kinship